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utilizing pages 3 through 11 to clarify and or state the Examiner's position with respect to various claims for the first time. MPEP § 706.02(j) clearly states that "[i]t is important for an examiner to properly communicate the basis for a rejection so that the issues can be identified early and the applicant can be given fair opportunity to reply." The present office action communicates the basis for various rejections for the first time in a final action, thereby depriving the applicants' of a fair opportunity to reply. Applicants note that the Examiner's response to applicants' arguments does not form any part of the rejections of record.

The office action states that MPEP § 706.07 requires that the present action be made final because no new grounds of rejection were introduced. However, pages 3 through 11 of the action introduce many new grounds for the rejections. For example, in several claims the office action states for the first time that the rejection relies on the principles of inherency. These are new grounds for the rejections. MPEP § 2112 sets forth separate and distinct requirements for a rejection based on inherency, including various burdens of proof. Because the prior office action did not assert reliance on inherency, applicants did not consider and did not analyze whether the rejection met such burdens. Because these new grounds for the rejections are first introduced in a final office action, applicants do not have a fair opportunity to respond.

MPEP § 706.07 also states that "[b]efore final rejection is in order a clear issue should be developed between the examiner and applicant." In the present application, the applicants have been deprived of having the complete grounds for the rejections and accordingly have not had the opportunity to develop clear issues with the Examiner.

In any event, the Examiner's analysis is incorrect and the claims are patentable over Eggers. In order to anticipate, the reference must identically disclose each and every claim recitation. Claim 1 recites a first instruction fetch unit and a second instruction fetch unit. Eggers discloses only a single instruction fetch unit that separately fetches two instructions.

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The rejection of record asserts that Eggers teaches a first instruction fetch unit and a second instruction fetch unit, relying on the assertion that "the fetch unit partitions itself among the threads." This is a factually inaccurate representation of the teachings of Eggers. The final office action clarifies that the rejection relies on page 14, left column, lines 38-48 of Eggers (reproduced below):

On the other hand, an SMT fetch unit can take advantage of the interthread competition for instruction bandwidth to enhance performance. First, it can partition this bandwidth among the threads. This is an advantage, because branch instructions and cache-line boundaries often make it difficult to fill issue slots if the fetch unit can access only one thread at a time. We fetch from two threads each cycle to increase the probability of fetching only useful (nonspeculative) instructions. In addition, the fetch unit can be smart about which threads it fetches, fetching only those that will provide the most immediate performance benefit.

Applicants first note that the foregoing paragraph refers to the fetch unit only in the singular ("an SMT fetch unit", "it", "the fetch unit"). In other words, only a single fetch unit is described. Moreover, Eggers does not teach that the fetch unit partitions "itself," as asserted by the office action. Eggers describes that the fetch unit can partition instruction bandwidth, not the fetch unit itself.

Accordingly, the single fetch unit described in Eggers does not identically describe the recited first and second instruction fetch units. Moreover, a single fetch unit which can partition instruction bandwidth does not identically describe the recited first and second instruction fetch units.

Claim 1 further recites a multi-thread scheduler unit coupled to said first instruction fetch unit and said second instruction fetch unit. The office action relies on page 13, left hand column, particularly the description of Fig. 1c, for allegedly identically

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disclosing this claim recitation. However, the cited portion merely generally describes how one form of SMT might work, and does not describe any particular structure. Applicants further note that the only mention of scheduling is in connection with scheduling machine resources, not scheduling threads. Moreover, the cited portion does not describe a multi-thread scheduler unit coupled to first and second instruction fetch units. In fact, the entire Eggers reference is devoid of any block diagram or other structural description of a fully functional SMT processor. The reference only merely describes different SMT capabilities that are proposed to improve multithreading performance.

The final office action admits that Eggers does not provide any structural description of a fully functional SMT processor. However, the office action asserts that such teaching is not necessary. (See page 4, lines 1-3 of the final office action). The office action relies on an unreasonably broad interpretation of the term "coupled" to make any structural recitation in the claims essentially meaningless. According to the office action, every component which is part of a processor is inherently "coupled" to every other component of the processor. Therefore, according to the office action, even though no structural components or interconnections are actually described in Eggers, every functional component mentioned in Eggers is "coupled" to every other functional component mentioned in Eggers, thereby inherently reading on every possible structural relationship which might be recited in the claims. This position is untenable.

MPEP § 2112 states that "[t]he fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic." MPEP § 2112 further states that "[i]n relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art." The examiner has not provided a sufficient factual basis to prove inherency.

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Applicants note that processors may have a multitude of possible architectures including different functional components, different structural components, and different interconnections between such components. Eggers describes many different possible functional arrangements for an SMT processor. However, it is not inherent in any of the SMT processor arrangements mentioned in Eggers that any particular component is coupled to any other particular component.

Even assuming, for the sake of argument, that Eggers described the recited first and second instruction fetch units and a multi-thread scheduler unit, it is not enough that such units might be coupled to each other. In order to rely on inherency, the Examiner must prove that in some SMT processor described by Eggers that such units must be coupled to each other. The Examiner must admit that in some SMT processor architectures it might be possible that the scheduler unit is not coupled to first and second instruction fetch units. Accordingly, it does not necessarily follow such units are coupled to each other and the office action's reliance on inherency fails.

Claim 1, taken in its entirety and read as a whole, recites structural components and interconnections between those structural components, including, among other things, a multi-thread scheduler unit coupled to said first instruction fetch unit and said second instruction fetch unit. Eggers, which fails to identically describe even the first and second instruction fetch units or the recited multi-thread scheduler unit, further fails to teach or suggest a multi-thread scheduler unit coupled to said first instruction fetch unit and said second instruction fetch unit, inherently or otherwise.

Claim 1 further recites an execution unit coupled to said scheduler unit, wherein said execution unit is to execute a first active thread and a second active thread. The final office action, for the first time, clarifies that the rejection relies on page 13, left column, lines 15, 25, 34, and 51-52 for the recited execution unit. By making the action final, applicants have been deprived of a fair opportunity to reply to this newly identified basis for the rejection.

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Applicants note that the cited portions do not describe any execution unit. Rather, the cited portion only generally describes that instructions are executed. In any event, applicants again note that Eggers does not appear to describe any particular structure for the SMT processor alluded to therein. Rather, Eggers appears to be an academic paper describing proposals for processor designers to further investigate SMT techniques to improve multithreading processors. The cited portion fails to describe an execution unit coupled to a scheduler unit. The Examiner appears to again be relying on an unreasonably broad interpretation of the term "coupled." Moreover, it is not inherent, in any SMT processor described by Eggers, that the execution unit be coupled to the scheduler unit. In some SMT processor architectures, the execution unit might not be coupled to the scheduler unit.

Claim 1 further recites a register file coupled to said execution unit, wherein said register file is to switch one of said first active thread and said second active thread with a first inactive thread. The office action relies on pages 14-15, particularly the section entitled "Register file and pipeline," for allegedly identically disclosing this claim recitation. Applicants are unable to identify any description in the cited portion that discloses a register file coupled to an execution unit or that the registers described in the "Register file" section are used to switch either a first or second active thread with an inactive thread. The office action goes on to identify actions described in Eggers as occurring at the fetch unit, not the register file. Namely, that the fetch unit may select two of an available eight threads for decoding. Applicants do not understand the Examiner's analysis with respect to how the fetching of instructions by Eggers' fetch unit teaches or suggest anything whatsoever in connection with the operation of Eggers' register file. The office action appears to be improperly conflating these two distinct components of Eggers in order to read on the claims. In any event, selecting among available threads for execution in an SMT is different from and does not teach or suggest the recited switching of an active thread with an inactive thread.

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With respect to numbered paragraph 11 in the final office action, the office action asserts that the Examiner is not conflating the register file with the fetch unit. However, the office action does not clarify what the Examiner is relying on and persists in referring to actions occurring at the fetch unit. The final office action asserts that Eggers describes "when the fetch unit switches one of said first active thread and said second active thread with a first inactive thread, the register files being accessed correspond to each particular thread being executed." This is a factually inaccurate representation of the teaching of Eggers made without citation to any corresponding portion of Eggers. Applicants are unable to identify any portion of Eggers which might correspond to such teaching. The final office action further asserts that "[s]o when the two threads are being executed, the corresponding register files for the two threads have been switched to and are being accessed. The register files effectively switch, along with the fetch unit, to one of said first active thread and said second active thread with a first inactive thread." Again this appears to be a factually inaccurate representation of the teaching of Eggers made without citation to any corresponding portion of Eggers. Applicants are unable to identify any portion of Eggers which might correspond to such teaching. In any event, a register file that switches with the execution of the threads is different from, and does not teach or suggest the recited register file which is to switch one of said first active thread and said second active thread with a first inactive thread.

By way if background, some embodiments of the present invention may relate to a multithreading processor which exhibits both simultaneous multithreading (SMT) capability and switch on event multithreading (SoEMT) capability. In contrast, Eggers describes only multithreading processors having either SMT capability or SoEMT capability. Accordingly, Eggers cannot possibly anticipate the present claims or render the present claims unpatentable. In fact, Eggers teach away from such a combination of functionality because Eggers clearly suggests using SMT capabilities instead of SoEMT capabilities. According to Eggers, "SMT was able to get higher instruction throughput and greater program speedups than the fine-grained multithreading processor" (i.e. an SoEMT processor). See Eggers, page 17, section entitled "SMT vs. fine-grained multithreading."

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With respect to paragraph 12 of the final office action, the foregoing, as explicitly stated, is provided by way of background.

For example, claim 1 recites an execution unit to execute a first active thread and a second active thread (e.g. SMT capability), and a register file to switch one of said first active thread and said second active thread with a first inactive thread (e.g. SoEMT capability). Among other things, Eggers fails to teach or suggest a multithreading processor with both these capabilities, as recited in claim 1.

Applicants note that the final office action does not address the foregoing argument, which does relate to what is recited in the claim.

For the foregoing reasons, in particular because Eggers fails to teach or suggest the various recitations noted above in claim 1, claim 1 is not anticipated by and is patentable over Eggers. Claims 2-8 depend either directly or indirectly from claim 1 and are likewise patentable.

With respect to claim 2, applicants note that Eggers does not describe how the "hardware contexts for eight threads" are otherwise interconnected. In any event, they do not appear to be coupled to the disclosed "register file." Applicants note that the office action relies on an unreasonably broad interpretation of the term "coupled" and, given the multiplicity of possible architectures, it is not inherent that the "hardware contexts" in Eggers are coupled to the register file in Eggers. Accordingly, claim 2 is separately patentable over Eggers.

With respect to claim 4, applicants note that the office action relies on Page 14, first paragraph, which does not appear to mention any decoders. The only mention of decoding applicants can identify is in the paragraph spanning the left and right columns on Page 14, which describes that Eggers single fetch unit selects subset of instructions from two threads for decoding. Accordingly, Eggers does not teach or suggest first and

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second decode units. As it is possible to use a single decode unit for two fetched instructions, it is not inherent that Eggers necessarily requires first and second decode units. The Examiner's comments with respect to "separate, independent, and distinct" are not understood. Assuming for the sake of argument, that the single fetch unit in Eggers is coupled to a single decode unit, a single decode unit cannot possibly read on both the recited first and second decode units. Claim 4 further recites that the first decode unit is coupled between the first instructions fetch unit and the scheduler and that the second decode unit is coupled between the first instructions fetch unit and the scheduler. Because many different architectures are possible, it is not inherent that Eggers requires the recited structure. Accordingly, claim 4 is separately patentable over Eggers.

With respect to claim 5, applicants again note that Eggers does not describe any particular structure for the SMT processor proposed therein. Moreover, Eggers at most describes a single fetch unit which can fetch two or more instructions in a given cycle for decoding by a single decode unit. This is different from and does not teach or suggest the structure of multiple (e.g. first through fourth) instruction fetch units as recited in claim 5. Applicants again note that Eggers describe only partitioning the instruction bandwidth, not partitioning the fetch unit. Accordingly, claim 5 is separately patentable over Eggers.

With respect to claim 6, applicants note that the register file mentioned in Eggers appears to have a different structure and function as compared to the recited four way register file. The final office action asserts that "a register file can have any number of ways." However, not every register file structure is suitable for structuring with multiple ways. Merely changing the size of the register file described in Eggers still does not read on the recited four way register file. Applicants are not arguing any feature not recited in claim 6. Accordingly, claim 6 is separately patentable over Eggers.

With respect to claim 7, the office action again appears to improperly conflate the functions of Eggers' fetch unit with Eggers' register file. The Examiner should unambiguously identify whether the rejection relies on Eggers' fetch unit or Eggers'

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register file for the recited switching, so that a full and fair response may be made. In the absence of such unambiguous analysis, the office action is in error as to what is taught or suggested by Eggers and fails to establish a prima facie case of obviousness.

Accordingly, claim 7 is separately patentable over Eggers.

With respect to claim 8, applicants again note that Eggers does not describe any particular structure for the SMT processor proposed therein. Moreover, Eggers at most describes a single fetch unit which can fetch two or more instructions in a given cycle for decoding by a single decode unit. This is different from and does not teach or suggest the structure of multiple (e.g. first through fourth) decode units as recited in claim 8.

Accordingly, claim 8 is separately patentable over Eggers.

With respect to independent claims 9 and 15, the office action misconstrues the Eggers reference. Claims 9 and 15 each recite switching a first active thread with a third thread, if the third thread is ready to execute. The office action relies on the description of the how Eggers' fetch unit operates for allegedly identically disclosing this claim recitation. However, the operation of the fetch unit in Eggers does not have anything to do with active thread switching. As acknowledged by the Examiner in the office action, active threads are those threads which are executing. Eggers' fetch unit selects among various inactive instructions for execution. However, at the time of the instructions fetch, such instructions would not be considered active threads by those skilled in the art. Rather, the selected instructions become active at the time of execution.

Accordingly, the office action is in error by relying upon operations occurring at Eggers' fetch unit to read upon either of the detecting or switching recitations, which relate to an active thread. As noted above, the cited portion of Eggers describes only a multithreading processor having SMT capability, not SoEMT capability. Accordingly, the only action Eggers teaches or suggests in connection with active threads during an execution cycle is the simultaneous execution of the active threads. When a stalling event occurs, the active thread becomes inactive and stops executing. The cited portion of Eggers, namely page 14, left hand column, describes that during the next instruction

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fetch cycle, a new instruction may be fetched to replace the now inactive instruction, but Eggers does not teach or suggest switching an active thread with a new thread after detecting a stalling event in the active thread.

With respect to paragraph 17 of the final office action, the foregoing is clearly discussing what is or is not described by Eggers, and not arguing features of the claims. In order to establish a prima facie case of obviousness, the Examiner must correctly identify what is taught by the reference. The foregoing is simply pointing out the errors in the Examiner's analysis. Applicants note that the office action does not take issue with the substance of applicants' argument. Namely, that the relied upon portion of the Eggers reference does not describe switching an active thread.

With respect to paragraph 18 of the final office action, the Examiner's response fails to address applicants' traversal. Applicants note that the office action does not take issue with the substance of applicants' argument. Namely, that the relied upon portion of the Eggers reference does not describe switching an active thread.

Because, among other things, Eggers fails to teach or suggest the recited switching said first active thread with a third thread, if the third thread is ready to execute, claims 9 and 15 are not anticipated by and are patentable over Eggers. Claims 10-14 depend from claim 9 and are likewise patentable. Claims 16-20 depend from claim 15 and are likewise patentable.

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In view of the foregoing, favorable reconsideration and withdrawal of the rejections is respectfully requested. If there are any questions regarding the present application, the Examiner is invited to contact the undersigned attorney at the telephone number listed below. If any fee insufficiency or overpayment is found, please charge any insufficiency or credit any overpayment to Deposit Account No. 02-2666.


Respectfully submitted,

March 28, 2005

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